

The Epidemiology of Acute Urinary Retention in Benign Prostatic Hyperplasia

Claus G. Roehrborn, MD

Department of Urology, The University of Texas Southwestern Medical Center, Baylor College of Medicine, Dallas, TX

One of the most important events in the natural history of BPH is acute urinary retention (AUR). Better estimates of AUR incidence are now available from both population-based studies and placebo control groups (patients diagnosed with BPH). Several strong risk factors for AUR have been identified by analytical epidemiology, the most important being serum PSA levels. When counseling patients with BPH who are considering watchful waiting, clinicians should also take into account prostate volume, maximum flow rate, and symptom severity. [Rev Urol. 2001;3(4):187–192]

© 2001 MedReviews, LLC

Key words: Acute urinary retention • Benign prostatic hyperplasia • Epidemiology • Risk factors

For a variety of reasons, acute urinary retention (AUR) is one of the most significant complications of long-term benign prostatic hyperplasia (BPH). In the past it has represented an immediate indication for surgery. Between 25% and 30% of men who underwent transurethral prostatectomy (TURP) had AUR as their main indication in older series,¹ and today most patients failing to void after attempted catheter removal still undergo surgery. For this reason alone, AUR is an important and feared event, from an economic standpoint as well as from the viewpoint of the patient. The patient originally has inability to urinate, with increasing pain, and eventually a visit to the emergency room, catheterization, follow-up visits to the physicians, an attempt at catheter removal, and eventual recovery or surgery, which is both painful and time consuming. In the older literature, the risk of recurrent AUR was cited as 56% to 64% within 1 week of the first episode and 76% to 83% in men with diagnosed BPH.^{2–4}

Etiology of AUR

The etiology of AUR is poorly understood. Prostate infection, bladder overdistension,⁵ excessive fluid intake, alcohol consumption, sexual activity, debility, and bed rest have all been mentioned.⁶

Prostatic infarction has been suggested as an underlying etiologic event.⁷ Spiro and colleagues⁸ found evidence for infarction in 85% of prostates removed for AUR versus 3% in prostates of men having surgery for symptoms only. In contrast, there was no evidence of infarction in six prostatectomy specimens removed from men who had surgery for AUR.⁹ Anjum and colleagues¹⁰ found fundamentally similar rates of infarction in 35 men who were in AUR versus no AUR (1.9% versus 3.0%).

From a clinical and prognostic point of view, spontaneous AUR should be separated from precipitated AUR, although this is by no means consistently done in the literature. Precipitated AUR refers to the inability to urinate following a triggering event such as non-prostate-related surgery, catheterization, anesthesia, ingestion of medications with sympathomimetic or anticholinergic effects, ingestion of antihistamines, or other events. All other AUR episodes are classified as spontaneous.^{11,12} The importance of differentiating the two types of AUR becomes clear when evaluating ultimate patient outcomes. Following spontaneous AUR, 15% of patients had another episode of spontaneous AUR, and 75% underwent surgery; after precipitated AUR, only 9% had an episode of spontaneous AUR, and 26% underwent surgery.¹¹

Epidemiology of AUR in BPH

Definition. The study of epidemiology involves the distribution and determinants of diseases in humans. Epidemiology can be *descriptive*

(description of disease incidence, mortality, and prevalence by person, place, and time) or *analytical* (a search for determinants of disease risk that may serve to increase prospects for prevention).¹³ Epidemiologists assess and compare rates of diseases within one population stratified by sex, age, and other demographic and socioeconomic parameters, and between populations of different culture, ethnicity, lifestyles, and diet.

Methods of studying the natural history of BPH. AUR is an event that takes place in the course of the natural history of the disease process. The natural history of BPH can theoretically be evaluated by studies using a variety of designs (see box).

Study Designs for Evaluation of BPH

1. Longitudinal studies of untreated cohorts of men diagnosed with lower urinary tract symptoms (LUTS) and clinical BPH by any definition (*watchful waiting cohorts*).
2. Studies of the behavior of men diagnosed with LUTS and BPH and enrolled in controlled studies of LUTS and BPH (*control groups*) and receiving either
 - a. *no treatment* (compared with active intervention)
 - b. *placebo* treatment (compared with medical treatment)
 - c. *sham* treatment (compared with device or surgical treatment)
3. Longitudinal studies of unselected (ie, undiagnosed) men living in the community who are less likely to progress and request or require therapy (*longitudinal population-based studies*).

There are problems associated with all these approaches. Concerning the *watchful waiting cohorts*, the first question to be resolved is whether or not it is ethical (or feasible) to enroll symptomatic men in such a study even if the disease studied is not fatal. Second, the very fact that the patients had an initial contact (and presumably subsequent contacts) with health care providers in the course of the study will bias them, leading to changes in outcome parameters of interest presumably different from those observed in an age-matched cohort of men who are similar in all parameters at baseline but who choose to participate (a cohort one might call "wild-type," in analogy to genetic language). Furthermore, in the course of such a natural history study, many diagnosed men will become more and more symptomatic and will desire and receive treatment, making them ineligible for further study participation and thus reducing the number of men available for analyses.

Concerning the incidence of AUR, data are available from population-based studies as well as from placebo control groups of BPH studies. These data can be discussed in terms of descriptive and analytical epidemiologic approaches.

Descriptive epidemiology. Older estimates of occurrence of AUR range from 4 to 15 to as high as 130 per 1000 person-years (calculated by Jacobsen and colleagues¹⁴ based on studies by Birkhoff and colleagues,¹⁵ Ball and colleagues,¹⁶ and Craigen and colleagues¹⁷); such estimates lead to 10-year cumulative incidence rates ranging from 4% to 73%. The self-reported rate of AUR in a cross-sectional study in 2002 Spanish men was 5.1%.¹⁸

More recent data from carefully controlled studies in better defined

Table 1
Descriptive Studies on the Incidence of Acute Urinary Retention (AUR)

Author/Source	Description of Cohort	No. of Cases	Cohort	Years of Follow-up	% Overall	%/Year	IR/1000 patient years	95% CI
Ball et al, 1981 ¹⁶	Watchful waiting study	2	107	5	1.9	0.37	3.7	
Craigen et al, 1969 ¹⁷	Watchful waiting study						15.0	
Birkhoff et al, 1976 ¹⁵	Watchful waiting study	10	26	3	39	13	130	
Wasson et al, 1995 ¹⁹	TURP vs. watchful waiting VA COOP	8	276	3	2.8	0.9	9.6	
Hunter et al, 1997 ¹⁸	Self-reported prior events in Spanish men	102	2002	?	5.1		50.9	
Barry et al, 1997 ²⁰	Prostatectomy candidates	40	500	4	8	2.5	25	
Meigs et al, 1999 ²¹	Physicians Health Study, self-reported	82	6100	3	1.3		4.5	3.1-6.2
Olmsted County, 1997 ²²	Community cohort 40-49 years old	57	2115	4			6.8	5.2-8.9
McConnell et al, 1998 ²⁸	Placebo group of Pless Study	99	1376	4	7.2	1.8	18	
Andersen et al, 1997 ²⁴	Placebo groups of 2-year BPH studies	57	2109	2	2.7	1.35	13.5	

populations shed additional light on the incidence rates in community dwelling men and clinical BPH populations (Table 1). AUR occurred in the VA Cooperative Study over 3 years in 1 man after TURP and in 8 of 276 men in the watchful waiting arm, for an incidence rate of 9.6/1,000 person-years.¹⁹ Barry and colleagues²⁰ reported outcomes of 500 men diagnosed by urologists with BPH, who were candidates for prostatectomy by established criteria but elected to be followed conservatively. In 1574 person-years, 40 episodes of AUR occurred at a constant rate throughout the 4 years of

follow-up, for an incidence rate of 25/1000 person-years.

During 15,851 person-years of follow-up in the Physicians Health Study, 82 men reported an episode of AUR, for an incidence rate of 4.5/1000 person-years (95% CI 3.1-6.2).²¹ Of the 2115 men aged 40 to 79 years in the Olmsted County Study, 57 had a first episode of acute urinary retention during 8344 person-years of follow-up (incidence 6.8/1000 person-years, 95% CI 5.2-8.9).²²

The best data from men diagnosed with BPH stem from the Proscar Long Term Efficacy and Safety Study (PLESS).²³ In PLESS, 1376 placebo-

treated men with enlarged prostates and moderate symptoms had complete follow-up over 4 years; 99 of them experienced an episode of AUR, for a calculated incidence rate of 18/1000 person-years. The placebo treatment groups from three 2-year studies with a similar patient population were meta-analyzed by Boyle and colleagues.²⁴ Of 2109 patients, 57 experienced AUR over the 2 years with a constant hazard, for an incidence rate of 14/1000 person-years (Table 1).

Analytical epidemiology. Several well-controlled studies have provided considerable insight into the risk

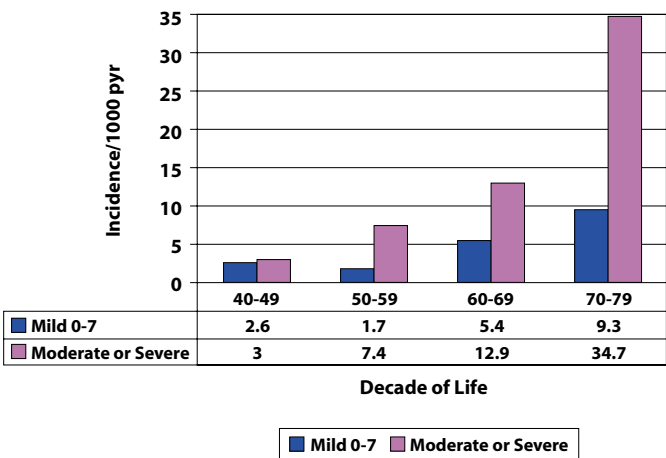


Figure 1. Incidence rates of AUR in Olmsted County Study by age and symptom severity. Data from Jacobsen et al.²²

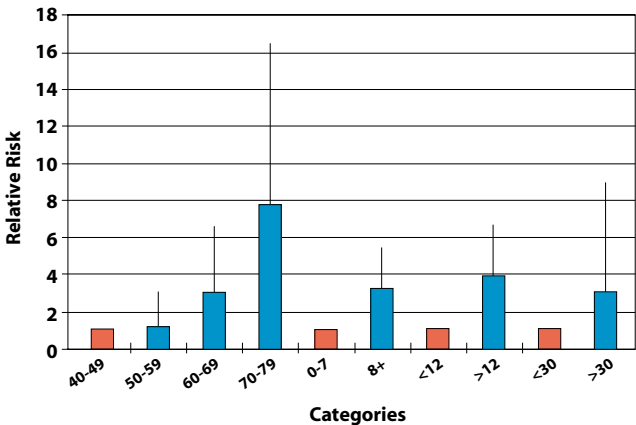


Figure 2. Relative risk of AUR in Olmsted County Study by age, symptom severity, peak flow rate, and prostate volume; the red columns represent the baseline and a relative risk (RR) of 1.0; the vertical lines represent the 95% CI. Data from Jacobsen et al.²²

factors for AUR. In the Physicians Health Study, rates increased with age and baseline symptom severity retention.²¹ In men with mild symptoms, AUR incidence increased from 0.4/1000 person-years for those 45 to 49 years old to 7.9/1000 person-years for those 70 to 83 years old. In men with symptom scores of 8 to 35, rates increased from 3.3/1000 person-years for those 45 to 49 years old to 11.3/1000 person-years for those 70 to 83 years old. Men with a clinical diagnosis of BPH and a symptom score of 8 or greater had the highest rates (age-adjusted incidence 13.7/1000 person-years). All seven lower urinary tract symptoms comprising the American Urological Association symptom index individually predicted AUR. The sensation of incomplete bladder emptying, having to void again after less than 2 hours, and a weak urinary stream were the best independent symptom predictors. Use of medications with adrenergic or anticholinergic side effects also predicted acute urinary retention.

In the Olmsted County Study, analyses focused on age, symptom severity, maximum flow rate, and

prostate volume²² (Figures 1 and 2). Incidence rates per 1000 person-years increased from 2.6 for men in their 40s to 9.3 for men in their 70s if they had mild symptoms, and from 3.0 to 34.7, respectively, if they had more than mild symptoms (Figure 1). The relative risk increased for older men, those with moderate to severe symptoms (3.2 times), those with a flow rate under 12 mL/sec (3.9 times), and those with a prostate volume > 30 mL by TRUS (3.0 times), all compared with a baseline risk of 1.0 times for the corresponding groups (Figure 2). The highest relative risk by proportional hazard models exists for 60- to 69-year-old men with more than mild symptoms and a flow rate < 12 mL/sec (10.3 times), and for 70- to 79-year-old men except if they had mild symptoms and a flow rate > 12 mL/sec. All other stratifications of men over 70 years had a relative risk (RR) ranging from 12.9 to 14.8 times (all compared with men 40 to 49 years old with mild symptoms and a flow rate > 12 mL/sec, for which the base risk is 1.0 times).

Although age in community

dwelling men is an important risk factor, in a BPH trial population of men already diagnosed with BPH, other factors can be analyzed. In the placebo groups of three 2-year studies²⁵ and a 4-year study (PLESS),^{12,26-28} prostate volume, serum prostate-specific antigen (PSA) levels, and symptom severity were all predictors of AUR episodes.

The incidence increased from 5.6% to 7.7% in men with a serum PSA of under 1.4 ng/mL and mild to severe symptoms, and from 7.8% to 10.2% for those with a serum PSA > 1.4 ng/mL over 4 years in PLESS.²⁶ In the 2-year studies, the rate of AUR was eight-fold higher in those with a serum PSA > 1.4 ng/mL (0.4% versus 3.9%), and threefold higher for a prostate volume > 40 mL (1.6% versus 4.2%).²⁵ A detailed analysis showed a near linear increase in risk for AUR with increasing thresholds of serum PSA (Figure 3) in PLESS, an observation that applied to both spontaneous and precipitated AUR.¹² The risk for both types of AUR increases with increasing serum PSA as well as prostate volume stratified by tertiles (Figure 4). An analysis of over 100 possible outcome

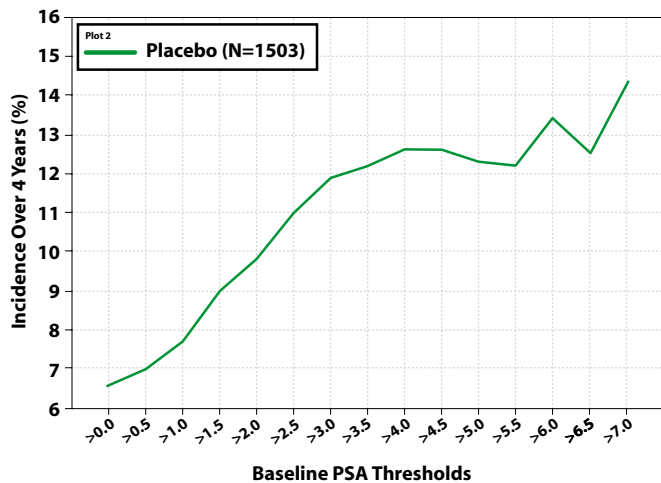


Figure 3. Incidence of spontaneous or precipitated AUR in the PLESS study over 4 years stratified by increasing thresholds of serum prostate-specific antigen (PSA) at baseline.

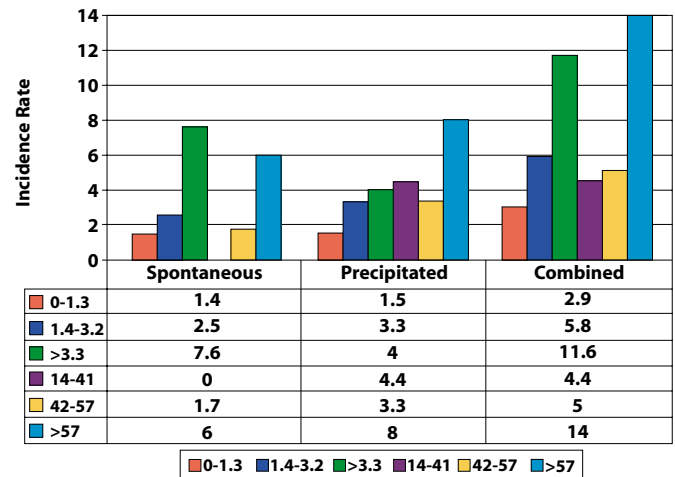


Figure 4. Spontaneous, precipitated, or combined AUR incidence over 4 years in the PLESS study stratified by tertiles of serum PSA or prostate volume at baseline.

predictors alone or in combination revealed that a combination of serum PSA, urination more than every 2 hours, symptom problem index, maximum urinary flow rate, and hesitancy were only slightly superior to PSA alone in predicting AUR episodes.²⁹

Conclusions

AUR is one of the most significant events in the course of the natural history of BPH. The concept that this disease is in fact progressive in nature is slowly being accepted. Although in the past uncertain estimates regarding the incidence rates of AUR existed, and almost one-third of patients presented in AUR for TURP, nowadays better estimates are available from population-based studies of community dwelling men, as well as from patients diagnosed with BPH (placebo control groups). Descriptive and analytical epidemiologic data have shown that the incidence rate per 1000 person-years is less variable in the community than previously assumed. The best controlled studies allow for an estimate between 5 and 25 per 1000 person-

years, or 0.5% to 2.5% per year. However, this risk is cumulative and increases with advancing age. Even at these seemingly low rates, the *cumulative risk* for a man in his 50s with more than mild symptoms of experiencing AUR if he lives to be 80 is about 20%; for a man in his 60s who lives another 20 years it is about 23%; and for a man in his 70s who lives another 10 years it is 30%. The risk in patients diagnosed with BPH is naturally higher, and analytical epidemiology has identified several strong risk factors for AUR, the most important being elevated serum PSA levels. In addition, prostate volume, maximum flow rate, and symptom severity should be considered when counseling patients presenting with LUTS and clinical BPH who are considering a course of watchful waiting. ■

[Note: Dr. Roehrborn acts as an investigator with MSD, the maker of Finasteride].

References

- Holtgrewe HL, Mebust WK, Dowd JB, et al. Transurethral prostatectomy: practice aspects of the dominant operation in American urology. *J Urol*. 1989;141:248-253.
- Breum L, Klarskov P, Munck LK, et al. Significance of acute urinary retention due to

intravesical obstruction. *Scand J Urol Nephrol*. 1982;16:21-24.

- Hastie KJ, Dickinson AJ, Ahmad R, Moisey CU. Acute retention of urine: is trial without catheter justified? *J R Coll Surg Edinb*. 1990;35:225-227.
- Klarskov P, Andersen JT, Asmussen CF, et al. Symptoms and signs predictive of the voiding pattern after acute urinary retention in men. *Scand J Urol Nephrol*. 1987;21:23-28.
- Powell PH, Smith PJ, Feneley RC. The identification of patients at risk from acute retention. *Br J Urol*. 1980;52:520-522.
- Stimson JB, Fihn SD. Benign prostatic hyperplasia and its treatment [review]. *J Gen Intern Med*. 1990;5:153-165.
- Graversen PH, Gasser TC, Wasson JH, et al. Controversies about indications for transurethral resection of the prostate [review]. *J Urol*. 1989;141:475-481.
- Spiro LH, Labay G, Orkin LA. Prostatic infarction. Role in acute urinary retention. *Urology*. 1974;3:345-347.
- Jacobsen SJ, Jacobson DJ, Girman CJ, et al. Natural history of prostatism: risk factors for acute urinary retention. *J Urol*. 1997;158:481-487.
- Anjum I, Ahmed M, Azzopardi A, Mufti GR. Prostatic infarction/infection in acute urinary retention secondary to benign prostatic hyperplasia. *J Urol*. 1998;160:792-793.
- Roehrborn CG, Bruskewitz R, Nickel GC, et al. Urinary retention in patients with BPH treated with finasteride or placebo over 4 years. Characterization of patients and ultimate outcomes. The PLESS Study Group. *Eur Urol*. 2000;37:528-536.
- Roehrborn CG, McConnell JD, Lieber M, et al. Serum prostate-specific antigen concentration is a powerful predictor of acute urinary retention and need for surgery in men with clinical benign prostatic hyperplasia. PLESS Study Group. *Urology*. 1999;53:473-480.
- Oishi K, Boyle P, Barry M, et al. Epidemiology and natural history of benign prostatic hyperplasia. 4th International Consultation on Benign

- Prostatic Hyperplasia. Plymouth, UK: Plymbridge Distributors; 1998:23–59.
14. Jacobsen SJ, Jacobson DJ, Girman CJ, et al. Natural history of prostatism: risk factors for acute urinary retention. *J Urol.* 1997;158:481–487.
 15. Birkhoff JD, Wiederhorn AR, Hamilton ML, Zinsner HH. Natural history of benign prostatic hypertrophy and acute urinary retention. *Urology.* 1976;7:48–52.
 16. Ball AJ, Feneley RC, Abrams PH. The natural history of untreated “prostatism.” *Br J Urol.* 1981;53:613–616.
 17. Craigen AA, Hickling JB, Saunders CR, Carpenter RG. Natural history of prostatic obstruction. *J R Coll Gen Practit.* 1969;18:226–232.
 18. Hunter DJ, Berra-Unamuno A, Martin-Gordo A. Prevalence of urinary symptoms and other urological conditions in Spanish men 50 years old or older [see comments]. *J Urol.* 1996;155:1965–1970.
 19. Wasson JH, Reda DJ, Bruskewitz RC, et al. A comparison of transurethral surgery with watchful waiting for moderate symptoms of benign prostatic hyperplasia. The Veterans Affairs Cooperative Study Group on Transurethral Resection of the Prostate. *N Engl J Med.* 1995;332:75–79.
 20. Barry MJ, Fowler FJ, Bin L, et al. The natural history of patients with benign prostatic hyperplasia as diagnosed by North American urologists. *J Urol.* 1997;157:10–15.
 21. Meigs JB, Barry MJ, Giovannucci E, et al. Incidence rates and risk factors for acute urinary retention: the health professionals followup study. *J Urol.* 1999;162:376–382.
 22. Jacobsen SJ, Jacobson DJ, Girman CJ, et al. Natural history of prostatism: risk factors for acute urinary retention. *J Urol.* 1997;158:481–487.
 23. McConnell JD, Bruskewitz R, Walsh P, et al. The effect of finasteride on the risk of acute urinary retention and the need for surgical treatment among men with benign prostatic hyperplasia. Finasteride Long-Term Efficacy and Safety Study Group [see comments]. *N Engl J Med.* 1998;338:557–563.
 24. Andersen JT, Nickel JC, Marshall VR, et al. Finasteride significantly reduces acute urinary retention and need for surgery in patients with symptomatic benign prostatic hyperplasia. *Urology.* 1997;49:839–845.
 25. Marberger MJ, Andersen JT, Nickel JC, et al. Prostate volume and serum prostate-specific antigen as predictors of acute urinary retention. Combined experience from three large multinational placebo-controlled trials. *Eur Urol.* 2000;38:563–568.
 26. Kaplan S, Garvin D, Gilhooly P, et al. Impact of baseline symptom severity on future risk of benign prostatic hyperplasia-related outcomes and long-term response to finasteride. The Pless Study Group. *Urology.* 2000;56:610–616.
 27. Roehrborn CG, Bruskewitz R, Nickel GC, et al. Urinary retention in patients with BPH treated with finasteride or placebo over 4 years. Characterization of patients and ultimate outcomes. The PLESS Study Group. *Eur Urol.* 2000;37:528–536.
 28. McConnell JD, Bruskewitz R, Walsh P, et al. The effect of finasteride on the risk of acute urinary retention and the need for surgical treatment among men with benign prostatic hyperplasia. Finasteride Long-Term Efficacy and Safety Study Group. *N Engl J Med.* 1998;338:557–563.
 29. Roehrborn C, Malice M-P, Cook T, Girman C. Clinical predictors of spontaneous acute urinary retention in men with LUTS and clinical BPH: a comprehensive analysis of the pooled placebo groups of several large clinical trials. *Urology.* 2001 (in press).

Main Points

- Acute urinary retention (AUR) is one of the most important complications of benign prostatic hyperplasia (BPH).
- For evaluating outcomes, it is important to distinguish between precipitating AUR (which follows a triggering event) and spontaneous AUR.
- BPH may be evaluated by controlled studies or by longitudinal (either watchful waiting or population-based) studies.
- Recent data from controlled studies have given better estimates of AUR incidence rates: 5 to 25 per 1,000 person-years; the risk is cumulative and increases with age.
- Analytical epidemiology studies show that incomplete bladder emptying, having to void again after less than 2 hours, and a weak urinary stream are the best risk predictors for AUR.
- In the important PLESS study, predictors of AUR were prostate volume, serum prostate-specific antigen (PSA) levels, and symptom severity.